REMARKS

The case has been amended to be in condition for allowance.

Claims 28-54 are pending.

This amendment amends claims 38 and 41. The full pending claim set is shown above.

Claims 30, 34-38, and 45 have been withdrawn from further consideration as being drawn to non-elected subjected matter. Applicants respectfully disagree; however, the withdrawal is noted. Applicants do not cancel these claims as they believe the claims depend from an allowable generic claim.

The Official Action objected to claim 38. The claim has been amended to correct the claim dependency. Accordingly, withdrawal of the objection is solicited.

The Official Action rejected claims 31, 33, and 47 under §112, first paragraph.

Specifically, the Official Action stated that the specification did not convey to one of skill in the art that applicants had possession of the claimed invention at the time the application was filed, i.e., the specification is silent as to "an elastic contact force (30, 32), recited in line 3 of claim 31. Claims 33 and 47 recite elastic deformable and elastic force.

Applicants respectfully disagree and ask that the original disclosure (specification and claim set) be reviewed.

The paragraph spanning pages 3-4 of the specification discloses:

> The above objects are provided by a device and a method according to the enclosed claims. In general words, the present invention makes use of a flexible printed circuit board, not only as a mounting support for electronics components and wiring, but also for mechanically supporting various components as well as acting as a main structural member for the entire microsystem. All components necessary for a microsystem may be mechanically mounted onto a flexible printed circuit board, which finally is **elastically** deformed to a required final shape. In the final shape, the resilience of the flexible printed circuit board is used **to apply elastic forces** on selected transducer components of the microsystem.

The final paragraph of specification page 5 discloses:

> When the size of a system decreases, the rigidness of any main structural member may be decreased. For microsystems, which traditionally anyway are assembled on rigid structures, **elastic** constructions would be possible to use. Sheets of **elastic** materials may either by itself, or in a folded or deformed manner, be enough stable to constitute a main structural member.

Specification page 6 discloses:

> Furthermore, on a microscale, foils of **elastic** materials, such as flexible printed circuit boards, can be considered to be rather stiff in relation to the typical loads it should carry. However, in a macroscale, i.e. considering a whole microsystem, the foil can still be considered to be easily **deformable**, and do also provide a useful resilient behaviour. By reshaping portions or the whole flexible printed circuit board, final structural shaped may easily be obtained, which at the same time may be used for providing forces onto some transducer components. Transducer microsystems operating to move different members, normally uses different types of forces, mostly frictional forces, between the contact points of a drive unit and the drive member to achieve the motion. Means for creating such normal forces between

different components have to be supplied. In a device according to the present invention, the flexible printed circuit board may also be used to accomplish these normal forces.

Specification page 9 discloses:

The actual mounting of the components may also be supported by the flexible printed circuit board 10. In fig. 2, a narrow tab 32 of the material of the flexible printed circuit board 10 may be cut out and used as a **spring**. For small items, such as microelectromechanical components 22, the force necessary to fix the components in position is not very large. By using relatively **short resilient members 32** of the flexible printed circuit board 10, **the elastic spring force may be enough to hold the component in position**. If the tab 32 is covered with a conducting layer at the side facing the microelectromechanical component 22, an electrical contact may also be formed.

The paragraph spanning specification pages 9-10 discloses:

The flexible printed circuit board 10 is **deformed** in a closed shell shape, which also may act as a casing for the microsystem. The flexible printed circuit board 10 also applies a force onto the microelectromechanical component 22, and this force may be used for achieving a mechanical and/or **electrical contact**. In both fig. 2 and fig. 3, a part of the flexible printed circuit board 10 is **elastically deformed**, and a microelectromechanical component 22 is positioned in the deformation path, whereby **the resilience of the deformed flexible printed circuit board 10 applies a spring force on the microelectromechanical component 22**.

The final paragraph of specification page 10 discloses:

There are several different applications when the contact forces between the drive units and the drive member has to be very high. In that case it is advan tageous to use an external support structure that improves the stiffness. Fig. 4 illustrates such a

> case, where an external rigid member 36 is used as a counteracting means for achieving a strong resilient force. A portion of a flexible printed circuit board 10, on which microelectromechanical component 22 are attached, is deformed and pressed between the jaws of the external rigid member 36. The distance between the jaws is slightly less than the microelectromechanical components 22 and the flexible printed circuit board 10 in an uncompressed state, and the entering of the flexible printed circuit board 10 into the external rigid member 36 causes a part of the flexible printed circuit board 10 to be compressed 38. This compression gives rise to an **elastic force** by the board material itself, which force may be quite high. The flexible printed circuit board 10 is thus arranged with an **elastic deformation** 38 substantially perpendicular to its surface, between the microelectromechanical component 22 and the external rigid member 36, whereby the intrinsic material **elasticity** of the flexible printed circuit board 10 provides the **elastic contact force**. The **deformation** may of course also take place e.g. between different microelectromechanical components 22. The external rigid member 36 is in this case only used for produce the force, but may also be combined to constitute a part of the main structural member. Note that the dimensions in fig. 4 are drawn in a different scale, compared with most other figures.

The paragraph spanning specification pages 15-16 discloses:

> Fig. 9 shows.... In step 110, the flexible printed circuit board is given its final shape by a **deformation step**, where the flexible printed circuit board is **elastically and maybe also plastically deformed** to accomplish a final structurally bearing shape. Geometrical structures providing locking means are in step 112 used for maintaining the deformation. In step 114, the locking is adjusted to achieve suitable positioning, forces and other properties of the microsystem. The process is finally ended at step 116.

The originally-filed claims make reference to the objected-to recitations.

See that original claim 3 recites "...said flexible printed circuit board (10) has an **elastic deformation**, whereby said flexible printed circuit board (10) forms a general support for internal (30, 32) and external forces."

Also see that original claim 4 recites "...said flexible printed circuit board (10) is elastically deformed to apply an **elastic contact force (30, 32)** to at least one of said components (22) of said electromechanical transducer, forming a mechanical contact." Pending claim 31 is identical to original claim 4.

Original claim 6 recites "...said flexible printed circuit board (10) **is elastically deformed to apply an elastic contact force (30, 32)** to at least one of said electrical or optical components (24), forming an electrical contact." See the correspondence to pending claim 33.

Original claim 20 recites "...applying an elastic force to at least one of said components (22) of said electromechanical transducer by reshaping at least a portion of said flexible printed circuit board (10)." This corresponds to pending claim 47.

From the above example extracts, it is clear that applicants had possession of the recited invention at the time the application was filed, the recitations being found in the originally-filed claims. Withdrawal of this rejection is therefore respectfully requested.

The Official Action rejected claims 41-43 under §112, second paragraph.

Claim 41 recites "...said flexible printed circuit board (10) is provided with geometrical structures (16, 18, 20; 32, 33, 34; 40, 42; 44, 46, 48) which are engagable to other ones of said geometrical structures (16, 18, 20; 32, 33, 34; 40, 42; 44, 46, 48) and to other members of said transducer microsystem."

Claim 41 has been amended to recite "...said flexible printed circuit board (10) is provided with geometrical structures (16, 18, 20; 32, 33, 34; 40, 42; 44, 46, 48) which are engagable <u>with one another</u> [to other ones of said geometrical structures (16, 18, 20; 32, 33, 34; 40, 42; 44, 46, 48) and to other members of said transducer microsystem]."

Withdrawal of the indefinite rejection is solicited.

The Official Action rejected claims 28-29, 32, 44, 46, and 48-49 as anticipated by SCOTT 6,118,072.

Applicants respectfully disagree.

In review, the present invention deals with the reduction of parts and simplifying of the assembly for a transducer microsystem, where the active transducer components are in the order of centimeters or less (see preamble of claim 28). This is achieved by using the flexible printed circuit board not only for electrical connections and for holding the individual components thereto, but also as the <u>dominating portion of the mechanical structure</u> keeping the transducer system

together (as per claim 28). Further, in the final shape, the resilence of the flexible printed circuit board is used to apply elastic forces on selected transducer components of the microsystem (as per dependent claims, e.g., claim 31, 33, 38). See the paragraph spanning specification pages 3-4.

See that independent claim 44 recites the invention as a microelectromechanical motor, comprising a transducer microsystem. See that independent claim 46 recites the invention as a method of assembling a transducer microsystem, with claim 47 reciting applying an elastic force to an electromechanical component by reshaping a portion of the flexible printed circuit board.

Applicants acknowledge with appreciation that the Official Action stated that claims 31, 33, and 47 were directed to allowable subject matter and would be allowable if rewritten in independent form including all the recitations of the base claim and any intervening claims.

In preferred embodiments, the flexible printed circuit board is provided with geometrical structures which may be used for locking and/or adjusting the final deformation of the flexible printed circuit board. See the first full paragraph of specification page 4.

Most structural parts, serving only as a support for the entire system, are eliminated by letting the printed circuit board also perform an overall mechanical support for the entire

system. This property was expressed as a "main structural member", "main" having the meaning of major part, principal, dominating or most important, and "structural" having the meaning of means for supporting an essential framework.

The Official Action stated that SCOTT discloses a device (10, column 3, lines 62-67) capable of being a transducer microsystem.

Applicants respectfully disagree.

It is true that SCOTT discloses a flexible circuit disposed within a conductive tube; and that the circuit may include a flexible substrate and one or more circuit elements, with circuit elements on one or both sides, and the substrate may be multi-layered. The tube may have any one of many cross-sectional shapes, including circular, oval, square, and rectangular. This is per the SCOTT Abstract.

Attention is directed to the first claim of SCOTT reciting a device, comprising an electrically conductive tube and a flexible circuit disposed within said tube. In SCOTT the teaching is to protect a circuit from external damage (physical and electrical fields) by enclosing the circuit within a conductive external tube. The tube provides a supporting framework for the circuit system located therein.

Applicants acknowledge that SCOTT teaches that their invention is directed generally to a device including a flexible circuit disposed within a conductive tube such as filters,

directional couplers, power dividers, amplifiers, microwave mixers, and microwave fuses. Accordingly, one of skill would understand that the SCOTT invention may relate to devices with flexible circuits. However, that said, the SCOTT invention is to protect a flexible circuit within a structurally and electrically protective tube. The SCOTT invention is not that of the present invention, and the independent claims of the present invention are not believed to read on SCOTT.

SCOTT does not disclose a transducer microsystem, a microelectromechanical motor comprising a transducer microsystem, or a method of assembling a transducer microsystem. The Official Action implicitly acknowledges this in stating "Scott discloses ...**capable of being** a transducer microsystem applied in micro-electromechenical motor (sic)...". This is because, although SCOTT discloses that their invention is directed generally to a device including a flexible circuit disposed within a conductive tube such as filters, directional couplers, power dividers, amplifiers, microwave mixers, and microwave fuses, there is no teaching or suggestion of using the SCOTT invention with a circuit involving electromechanical transducers physically attached to the circuit board (serving also as the main structural member). See that claim 28, the third recitation requires "a number of electromechanical components of an electromechanical transducer, physically attached to said main structural member...".

At best, SCOTT may be capable of being the electronics part of a transducer system, but SCOTT does not disclose use with a transducer system comprising electromechanical transducers.

In any event, SCOTT does not disclose each recitation of the independent claims and therefore, the pending claims are not anticipated.

As to claim 28, see the initial two recitations of:

"a main structural member, constituting a dominating part of a supporting framework of entire said transducer microsystem;

"said main structural member being a flexible printed circuit board;...".

The Official Action reads these recitations onto flexible circuit 12 of SCOTT. SCOTT discloses a device 10 constructed to include a flexible circuit 12 disposed within an electrically conductive tube 14. The circuit 12 is bent and in tension engagement with the tube 14. In the embodiment shown in Figure 2, the circuit 12 has two bent portions 15, 16 connected by a straight center portion 17, giving the circuit 12 an "S"-shaped cross-sectional shape. The circuit 12 includes a flexible substrate 22 and circuit elements 24.

Thus, SCOTT discloses a flexible printed circuit board. However, SCOTT does not disclose that the circuit board 12 is a dominating part of a supporting framework of the entire transducer microsystem as recited. Again, apart from there being

no disclosure of a transducer microsystem, SCOTT does not disclose the circuit board being a dominating part of the supporting framework of the SCOTT system. Clearly, to the extent that a supporting framework is disclosed, the conductive tube 14 is the supporting framework.

See the above, as well as SCOTT column 4, first paragraph disclosing "bent portions 15, 16 include sharply bent portions 18, 19, respectively, that act as cantilevered springs to counter act each other, keep the straight portion 17 in tension, and secure the circuit 12 within the tube 14." The tube 14 provides the supporting framework of the SCOTT apparatus, not the circuit board 12. Accordingly, for this reason alone the anticipation rejection is not viable.

Further, see the last two recitations of claim 28:

"a number of electromechanical components of an electromechanical transducer, physically attached to said main structural member,

"said flexible printed circuit board comprising electrical connections to said electromechanical components of said electromechanical transducer."

For the recitation of electromechanical components, the Official Action offers elements 24, and column 4, lines 26-29:

> Many types of circuit elements 24 may be part of the circuit 12, including inductors, capacitors, resistors, diodes, and transistors. The circuit elements 24 may also include integrated circuits, including processors and application specific integrated circuits.

This passage does not disclose electromechanical components generally and does not disclose any electromechanical components of an electromechanical transducer specifically, and accordingly SCOTT is not anticipatory.

See the first page of the present specification stating that "[t]ransducers are components or devices that transduces one energy form to another. Normally the transducers are divided in actuators and sensors even though there are many that can operate both as sensors and actuators. A sensor transforms an external stimulus to another useful energy form, preferably an electrical signal. An actuator essentially makes the opposite. A signal, preferably electrical, is transformed into any other useful energy form. Among the useful energy forms or external stimuli can be included mechanical, acoustic, electrostatic, electromagnetic, magnetic, optical, thermal, biological, biomedical, medical, chemical and atomic force energy. An electromechanical transducer is thus an actuator, transforming an electrical signal into a mechanical motion, and/or a sensor, transforming a mechanical motion into an electrical signal. Depending on application, the energy forms can be further subdivided e.g. mechanical transducers are typically divided into subgroups such as piezoelectric, electrostrictive, shape memory, inertial and resonant effects."

Nothing in SCOTT discloses use of "a number of electromechanical components of an electromechanical transducer."

Thus, for this additional reason SCOTT is not anticipatory.

Independent claims 44 and 46 have similar recitations. Accordingly, reconsideration and withdrawal of the anticipation rejection are respectfully solicited.

Not all features of the dependent claims are disclosed by SCOTT.

Claim 29 recites the transducer operating by shape memory. The Official Action indicates anticipation by elements 24, column 4, lines 26-29 (reproduced above). None of the listed inductors, capacitors, resistors, diodes, and transistors are shape memory devices.

Claim 41, as amended, recites "said flexible printed circuit board (10) is provided with geometrical structures (16, 18, 20; 32, 33, 34; 40, 42; 44, 46, 48) which are engagable <u>with one another</u>." Such structures are not found in SCOTT. The Official Action does not offer any SCOTT element as disclosing these recited geometrical structures.

Also, as to the above argument concerning the SCOTT circuit board being the recited main structural element, see claim 30 requires that "said flexible printed circuit board (10) has an elastic deformation, and said flexible printed circuit board (10) forms a general support for internal (30, 32) and external forces." The SCOTT circuit board does not form a general support for external forces, as clearly the tube 14 provides such support.

In view of the above, reconsideration and allowance of all the pending claims are respectfully requested.

Respectfully submitted,

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February 14, 2003